METHOD AND APPARATUS FOR COMMUNICATION WITHIN A VEHICLE DISPATCH SYSTEM

Background of the Invention

Field of the Invention

This invention relates in general to vehicle dispatch systems, and in particular to the communication of assignment messages within vehicle dispatch systems.

Description of the Related Art

A number of vehicle dispatch systems exist for the tracking and controlling of fleets such as taxicabs, delivery trucks, and the like. These systems typically communicate requests for dispatch to the vehicles in the fleet and then match acceptance of the request to the particular request. Key criteria of vehicle dispatch systems, whether manual or automatic, simple or complex, include the system cost, the system performance, and the fairness and timeliness of the selection process.

Historically, two-way radio networks have been utilized for vehicle dispatch. Voice communication is the primary communication tool for information gathering and decision making relating to the distribution of assignments in these systems. A dispatch center broadcasts a message of a new assignment location either via a data network or a voice network to the drivers of the various vehicles in the fleet; and each individual driver replies with his/her acceptance or rejection of the assignment to the dispatch center. Typically, the driver's reply is accomplished via a voice network such as a cellular phone or two-way radio.

There are several drawbacks to these vehicle dispatch systems. First, the driver must be alert at all times to listen to the assignment messages from the dispatch center and rapidly determine if the assignment location is within his/her range. The driver must make a quick decision for each message of whether to accept the job or not. In some fleets, if the driver affirmatively replies to the dispatch center and then does not get to the assignment location within a pre-

determined amount of time he can be fined. The combination of the rapid assignment messaging and decision-making and the potential for fines creates high stress levels in the drivers of the vehicles.

A second drawback of the traditional vehicle dispatch systems is that some of the drivers will answer any call, even if not close to the assignment location, motivated by a desire to maximize income or challenge the system. This creates an environment wherein the customer suffers from not receiving the most rapid service. Further, drivers from competing fleets can monitor the frequency of message transmission with a scanner and "steal" the assignments from the drivers who the message was targeted to reach.

Further, the broadcast of the assignment message in traditional vehicle dispatch systems is made throughout the entire territory covered by the fleet. In areas where there is a shortage of radio frequency channels, the available channels are rapidly filled to capacity. The expense of maintaining existing channels and/or petitioning the local government for new channels can be out of reach for many dispatch businesses.

Today, vehicle dispatch systems designed to alleviate some of the previously described drawbacks typically focus communications and decision-making at the dispatch center. Information such as geographical location and current job status of a selected vehicle is established; and then decisions regarding sending the current dispatch message to that selected vehicle are made by comparing that information either manually or automatically to some pre-defined criteria in the dispatch center. Automatic vehicle locator systems that automatically track the location of managed vehicles and then report this information to a dispatcher are frequently utilized. Advanced automatic vehicle locator systems further automatically identify the nearest vehicle to a location to further facilitate the dispatcher's accuracy. In some systems, the geographical location is compared to known locations of authorized vehicles and dispatch of the message is denied to the selected vehicle if the selected vehicle's location does not correspond to one of the known locations.

Other vehicle dispatch systems automatically assign jobs to the closest available vehicle and then inform the driver of the assignment via some other channel, such as the driver's mobile pager. In this method, no assurance is given

that the driver receives the notification or is actually available to take the assignment. The driver actually has no method to decline the assignment in this type of system.

The drawback of all of these systems is that the control rests within the dispatch center completely and the complexity of the system communications is increased greatly. Further the channel utilization increases since each call must be sent individually to each selected driver. Lastly, the systems still rely heavily on the dispatcher to make decisions and perform monitoring of the vehicles. This leads to a high degree of errors and confusion.

What is needed is a method to reduce the loading of the channels used for vehicle dispatch, reduce the decision-making stress on the vehicle drivers, and at the same time retain the automatic sorting mechanisms of the dispatch center - based systems.

Brief Description of the Several Views of the Drawings

FIG. **1** is a block diagram of a vehicle dispatch system;

FIG. **2** is an electrical block diagram of a wireless communication device for use within the vehicle dispatch system of FIG. **1**;

FIG. **3** is an illustration of an assignment message for communication within the vehicle dispatch system of FIG. **1**;

FIGs. **4**, **5**, and **6** illustrate various decision-making criteria for use within the wireless communication device of FIG. **2**;

FIGs. **7**, **8**, and **9** are electrical block diagrams of alternate embodiments of the wireless communication device of FIG. **2**;

FIGs. **10** and **11** are flowcharts illustrating the operation of the wireless communication device of FIG. **2** in accordance with the present invention;

FIG. **12** is a flowchart illustrating more detail of the operation of FIGs. **10** and **11**;

FIG. **13** is a flowchart of the operation of a dispatch center for use within the vehicle dispatch system of FIG. **1**;

FIG. **14** is an alternate embodiment of the assignment message of FIG. **3**; and

FIGs. **15**, **16**, and **17** illustrate various decision making criteria for use within the vehicle dispatch system of FIG. **1**.

Detailed Description of the Invention

Referring to FIG. 1, a vehicle dispatch system **10** for the management of a fleet **12** of vehicles **14** such as taxicabs, delivery trucks and the like is illustrated. The vehicle dispatch system **10** comprises a message input device **24**, such as a telephone or computer terminal, connected through a conventional public switched telephone network (PSTN) **30** by a plurality of conventional telephone links **26** to a dispatch center **16**. It will be appreciated by one skilled in the art that the message input device **24** may also communicate with the dispatch center **16** via alternative communication means such as radio frequency (RF) channels, satellite links, or Internet.

The dispatch center **16** functions in a wide variety of manners ranging from fully manual systems to automatic systems employing complex tracking methods. The dispatch center **16** includes a dispatch controller **18**, a dispatch transmitter **20**, and a dispatch receiver **22**. The dispatch controller **18** oversees the operation of the dispatch transmitter **20** and the dispatch receiver **22** through one or more communication links **42**, which typically are conventional telephone links, and additionally can include RF, microwave, or other high quality audio communication links. The dispatch controller **18** encodes inbound requests for dispatch **28** into outbound assignment messages **32**, and decodes inbound replies **38** from the vehicles **14** for matching of a request for dispatch **28** with a vehicle **14** that affirmatively replies. The dispatch controller **18** preferably includes a timer **19** for managing the scheduling of assignments. The dispatch controller **18** schedules the assignment message **32** for transmission by the dispatch transmitter **20,** via a transmit antenna **34,** to each vehicle **14** of the fleet **12** on at least one outbound radio frequency (RF) channel such as a first communication channel **35**. Each vehicle **14** includes a wireless communication device **36** capable of receiving and processing the assignment messages **32**.

It will be appreciated that the vehicle dispatch system **10** may function utilizing any wireless RF channel for the first communication channel **35**, for example, a one or two way pager channel, a mobile cellular channel, or a mobile

radio channel. In the following description, the RF communication channel refers to any of the wireless RF channels listed above or an equivalent. Each wireless communication device **36** assigned for use in the vehicle dispatch system **10** has an address **48** assigned thereto, which is a unique selective call address. The address **48** enables the transmission of the assignment message **32** from the dispatch controller **18** only to the addressed wireless communication device **36**. The address **48** also identifies the replies **38** sent by the wireless communication device **36** over at least one outbound radio frequency (RF) channel such as a second communication channel **39**; and received at the dispatch controller **18** through the dispatch receiver **22** via a receive antenna **40**. A list of the assigned addresses for each of the wireless communication devices **36** is stored in the dispatch controller **18** in the form of a vehicle subscriber database.

FIG. **2** is an electrical block diagram of a wireless communication device **36** for use within the vehicle dispatch system **10** of FIG. **1**. The wireless communication device **36** includes an antenna **44** for intercepting transmitted signals from the dispatch center **16** of the vehicle dispatch system **10**. The antenna **44** is coupled to a receiver **46** employing conventional demodulation techniques for processing the communication signals received from the dispatch center **16** such as the assignment message **32**. The receiver **46** is capable of receiving and demodulating voice as well as data signals.

FIG. **3** is an illustration of the assignment message **32** for communication with the wireless communication device **36** of FIG. **2**. The assignment message **32** preferably includes an address **48**, a location parameter **50**, and a data **52**. The address **48** identifies the wireless communication device **36** for which the assignment message **32** is directed. The location parameter **50** identifies the geographical location of the assignment being transmitted in the data **52** of the assignment message **32**. The data **52** includes all details of the assignment such as customer name, number of passengers, the required time of pick-up, etc.

Referring back to FIG. **2**, coupled to the receiver **46** is an assignment manager **58** utilizing conventional signal processing techniques for processing the received assignment messages. Preferably, the assignment manager **58** is similar to the MC68328 micro-controller manufactured by Motorola, Inc. of

Schaumburg, Illinois. It will be appreciated that other similar processors can be utilized for the assignment manager **58**, and that additional processors of the same or alternative type can be added as required to handle the processing requirements of the assignment manager **58**.

The assignment manager **58** is coupled to a memory **54** preferably including a random access memory (RAM), a read-only memory (ROM), and an electrically erasable programmable read-only memory (EEPROM). The assignment manager **58** decodes the address **48** in the received assignment message **32**, compares the decoded address with a device address **55** stored in a memory **54**, and when a match is detected, proceeds to process the location parameter **50** of the assignment message **32**. The processing of the location parameter **50** by the assignment manager **58** comprises determining whether to delete the assignment message **32** or process the assignment message **32**.

Coupled to the assignment manager **58** is a processor **60**. Preferably, the processor **60** is similar to the MC68328 micro-controller manufactured by Motorola, Inc. of Schaumburg, Illinois. It will be appreciated that other similar processors can be utilized for the processor **60**, and that additional processors of the same or alternative type can be added as required to handle the processing requirements of the processor **60**.

Once the assignment manager **58** determines that the assignment message **32** should be processed, it sends the assignment message **32** to the processor **60**. Upon receipt of the assignment message **32**, the processor **60** stores the assignment message **32** in the memory **54**. The processor **60** also sends a command to an alerting device **64** to notify the driver of the vehicle **14** in which the wireless communication device **36** is located that the assignment message **32** has been received. In one embodiment, the alerting device **64** comprises a speaker and associated speaker drive circuitry capable of playing both melodies and voice recordings. Upon receiving a command from the processor **60** to play a message receipt alert, the alerting device **64** plays an audible alert. The driver then chooses to review the data **52** of the assignment message **32** on a display screen in the case of data messages or play the recorded voice message in the case of voice messages.

The alerting device **64**, in another embodiment, includes a display to generate a visual notification of the assignment message receipt. When the display receives the command from the processor **60** that the assignment message **32** has been received and stored in memory **54**, a message indication is displayed. The message indication, for example may be the activation of one of a plurality of message icons. Selection by the driver of the message indicator associated with the assignment message **32** will display the data **52** of the assignment message **32** on the screen in the case of data messages and play the recorded voice message in the case of voice messages. Alternatively, the data **52** of the assignment message **32** is displayed on the display screen in response to a command from the processor **60** with no required input from the driver. The display may be, for example, a full or partial starburst liquid crystal display. It will be appreciated that other similar displays can be utilized for the display.

Preferably, the assignment manager **58** is programmed to include a criteria parameter **62** for comparison of the location parameter **50** of the assignment message **32** with a current location **56** stored in the memory **54**. When the location parameter **50** corresponds to the current location **56**, the assignment manager **58** passes the assignment message **32** to the processor **60** for message processing.

The criteria parameter **62** is a pre-set metric for filtering the assignment message **32** received by the wireless communication device **36** to be seen only by the vehicles **14** within the fleet **12** that meet the specified criteria. The criteria parameter **62** may be a calculation, an equation, a function, or a comparison value. The criteria parameter **62** may be changed in response to receipt of a programming message, in response to a timer timeout, or in response to a direct reprogramming of the assignment manager **58**.

Utilization of a criteria parameter within an assignment manager included within a wireless communication device greatly reduces the burden of the vehicle driver by filtering out assignments automatically that are outside his/her current range of assignment acceptance. The criteria parameter is programmable and therefor may be changed by the driver or by the fleet manager as required. Further, by placing the decision within the vehicle, the dispatch center is alleviated

of the task of tracking each vehicle in the fleet, greatly simplifying the operation of the dispatch center and at the same time reducing traffic congestion on the communication channels.

FIGs. **4**, **5**, and **6** illustrate various metrics for the criteria parameter **62**. It will be appreciated by those skilled in the art that other metrics may also be used for the criteria parameter **62**. In FIG. **4**, the criteria parameter **62** is a perimeter **68** surrounding the assignment location **66** established at a radius **70** from the assignment location **66**. When the wireless communication device **36** receives the assignment message **32** including the location parameter **50**, the assignment manager **58** compares the location parameter **50** corresponding with the assignment location **66** to the current location **56** of the vehicle **14** in which the wireless communication device **36** resides. When the current location **56** is within the perimeter **68**, the assignment message **32** will be sent to the processor **60** for further processing. When the current location **56** is not within the perimeter **68**, the assignment message **32** will be deleted, and the driver of the vehicle **14** would never even be aware that it was received, thereby reducing unnecessary message receipt by the driver of the vehicle.

In FIG. **5**, the criteria parameter **62** is a driving distance **72** away from the assignment location **66**. Upon receipt of the assignment message **32**, the assignment manager **58** calculates the driving distance from the current location **56** of the vehicle **14** in which the wireless communication device **36** resides to the assignment location **66** that corresponds to the location parameter **50**. When the calculated driving distance is within the driving distance **72** set for the criteria parameter **62** the assignment message **32** will be sent to the processor **60** for further processing. When the calculated driving distance is not within the driving distance **72** set for the criteria parameter **62**, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received. This process thereby limits the receipt of assignment messages by the vehicle driver to those within a reasonable driving distance.

Preferably, the assignment manager **58** includes a navigation program for the area in which the fleet **12** operates. The assignment manager **58** uses the

navigation program to calculate the driving distance from the current location **56** to the assignment location **66**.

The filtering by driving distance and by perimeter from the assignment location eliminates problems of drivers affirmatively replying to assignment messages clearly outside their range for the purpose of maximizing their own income, thereby enhancing system performance and customer satisfaction.

In FIG. **6**, the criteria parameter **62** is the travel time **78** equal to the difference between an estimated arrival time **74** and a current time **76**. Upon receipt of the assignment message **32**, the assignment manager **58** determines the estimated arrival time **74** to the assignment location **66**. The current time **76** is subtracted from the estimated arrival time **74** to calculate a travel time. When the calculated travel time is within the travel time **78** assigned to the criteria parameter **62**, the assignment message **32** will be sent to the processor **60** for further processing. When the calculated travel time is not within the travel time **78** assigned to the criteria parameter **62**, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received. This process thereby limits receipt of assignment messages by vehicle drivers to those that the driver could arrive at within a reasonable timeframe.

Preferably, the assignment manager **58** includes a smart program for tracking of traffic conditions coupled to the assignment manager **58**. The smart program calculates the travel time required based on the latest received traffic conditions. Alternatively, the assignment manager **58** may include a program incorporating average travel times and uses the average travel times to calculate the travel time from the current location **56** to the assignment location **66**.

The criteria parameter **62** alternatively further includes hours of operation for the vehicle **14**. The hours of operation in one embodiment are set by the driver of the vehicle at the beginning of each shift. Alternatively, the hours of operation are set either manually or automatically via the receipt of a message from the dispatch center. When the estimated arrival time does not fall between the hours of operation, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received.

In another embodiment, the criteria parameter **62** is a type of vehicle that the driver of the vehicle **14** is using at that time. For example, passenger transportation fleets typically include limousines, cars, small cars, vans, and buses. When the location parameter **50** of the assignment message **32** is the number of passengers to be picked up and the criteria parameter **62** is the type of vehicle, the assignment message **32** is deleted if the number of passengers do not fit within that type of vehicle.

The examples above illustrate the variety of criteria parameter **62** programmed based on the type of fleet, type of business, and needs of the dispatch center. It will be appreciated by those skilled in the art that other metrics may also be used for the criteria parameter **62**.

FIG. **7** is an alternate embodiment of the wireless communication device **36**. The reference numbers of the embodiment of FIG. **2** have been retained for those elements that are common. The wireless communication device **36** of FIG. **7** includes all the elements and functionality illustrated in FIG. **2** and further comprises a transmitter **80** and a device transmit antenna **82**.

The transmitter **80** is coupled to the processor **60** and is responsive to commands from the processor **60**. When the transmitter **80** receives a command from the processor **60**, the transmitter **80** sends the reply **38** via the device transmit antenna **82** to the dispatch center **16**. The reply **38** in one embodiment is transmitted over the first communication channel **35**, the same channel used to communicate the assignment message **32**. Using the same communication channel for both sets of communications eliminates the need for multiple channels and is desirable in regions where there is a shortage of available channels. In another embodiment, the reply **38** is transmitted over the second communication channel **39**. Using a different channel for the reply reduces the traffic on the first communication channel and is desirable in regions where the communication channels are congested.

The reply **38** preferably includes an affirmative indication to the dispatch center that the vehicle **14** containing the wireless communication device **36** will fulfill the assignment contained within the data **52** of the assignment message **32**. The reply **38** preferably also includes a vehicle identification and the vehicle's

current location **56** and estimated travel time **78** to the assignment location **66**. It will be appreciated that additional information may be included in the reply **38**.

FIG. **8** is an alternate embodiment of the wireless communication device **36.** The reference numbers of the embodiments of FIGs. **2** and **7** have been retained for those elements that are common. The wireless communication device **36** includes all the elements and functionality illustrated in FIG. **7** and further comprises a user interface **86**.

In the embodiment of FIG. **8**, after the processor **60** sends a command to the alerting device **64**, it waits for a user input **84** from the user interface **86**. The processor **60** commands the transmitter **80** to transmit a reply **38** via the device transmit antenna **82** in response to receipt of the user input **84** from the user interface **86**. The user interface **86** may be a button press, a series of button presses, a voice response by the driver of the vehicle **14**, or some other similar method of manual response initiated by the driver of the vehicle to the wireless communication device **36**.

Use of the user interface **86** leaves the control of acceptance or rejection of an assignment message with the driver of the vehicle while still filtering assignment messages obviously outside of his/her area. This two step filtering process: the first being automatic by the assignment manager and the second being manual via the user interface, gives the driver of the vehicle control of the matching of assignments, an improvement over the dispatch center – based systems which eliminate all driver control of assignment matches.

FIG. **9** is an alternate embodiment of the wireless communication device **36.** The reference numbers of the embodiment of FIG. **2** have been retained for those elements that are common. The wireless communication device **36** includes all the elements and functionality illustrated in FIG. **2** and further comprises a global positioning satellite (GPS) receiver **88** and GPS antenna **90**.

The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. GPS uses these "man-made stars" as reference points to calculate positions accurate to a matter of meters. The GPS receiver **88** uses the satellites in space as reference points for locations here on earth. The GPS receiver **88** measures distance using

the travel time of radio signals. The GPS receiver **88** has very accurate timing to measure travel time. Along with distance, the GPS receiver **88** knows exactly where the satellites are in space. Finally the GPS receiver **88** corrects for any delays the signal experiences as it travels through the atmosphere.

The GPS receiver **88** receives a plurality of signals **89** via the GPS antenna **90** corresponding to the current location **56**. The GPS receiver **88** is coupled to the memory **54** and stores the current location **56,** determined from the processing of the plurality of signals **89**, in the memory **54** for later use by the assignment manager **58** as described previously with regards to FIG. **2**. The GPS receiver **88** provides an accurate method for the wireless communication device **36** to determine the vehicle's current location.

FIG. **10** is a flowchart illustrating the operation of the wireless communication device **36** in accordance with the present invention. As indicated in step **92** of FIG. **10**, the wireless communication device **36** is normally in the standby mode for optimal power savings. In Step **94**, the wireless communication device **36** periodically checks for receipt of the assignment message **32**. When no assignment message **32** is received, the wireless communication device **36** returns to the standby mode of Step **92**. In Step **96**, when the assignment message **32** is received, the wireless communication device **36** checks for the presence of the location parameter **50** in the assignment message **32**. In Step **98**, when no location parameter **50** is included in the assignment message **32**, the wireless communication device **36** implements whatever default instructions have been programmed into the assignment manager **58** and the processor **60**. The default instruction, for example, may be the processing of the assignment message, the deletion of the assignment message, or the sending of a query for more information from the dispatch center. In Step **100**, when the location parameter **50** is included in the assignment message **32**, the assignment manager **58** compares the location parameter **50** to the current location **56** stored in the memory **54**. When the location parameter **50** does not correspond to the current location **56**, the wireless communication device **36** goes back to Step **92**, the standby state operation. In Step **101**, when the location parameter **50** corresponds

to the current location **56**, the processor **60** processes the assignment message **32**. The process then continues to node **B** as described in FIG. **12**.

Processing the assignment message **32** only upon a defined correspondence between the location parameter **50** and the current location **56** greatly reduces the assignment messages being received and processed by each individual driver. This automatic filter ensures the driver only is alerted to assignments in which there is a probability that he/she would be within the scope of the area of the assignment location.

FIG. **11** is a flowchart illustrating an alternate operation of the wireless communication device of FIG. **2** in accordance with the present invention. As indicated in step **92** of FIG. **10**, the wireless communication device **36** is normally in the standby mode for optimal power savings. In Step **94**, the wireless communication device **36** periodically checks for receipt of the assignment message **32**. When no assignment message **32** is received, the wireless communication device **36** returns to Step **92** in standby mode. When the assignment message **32** is received, the wireless communication device **36** proceeds to Step **96** and checks for the presence of the location parameter **50** in the assignment message **32**. In Step **98**, when no location parameter **50** is included in the assignment message **32**, the wireless communication device **36** implements whatever default instructions have been programmed into the assignment manager **58** and the processor **60**. In Step **102**, when the location parameter **50** is included in the assignment message **32**, the assignment manager **58** compares the location parameter **50** to the current location **56** stored in the memory **54** using the criteria parameter **62** contained within the assignment manager **58**. When the location parameter **50** does not meet the criteria parameter **62** in relation to the current location **56**, the wireless communication device **36** goes back to Step **92**, the standby state operation. In Step **103**, when the location parameter **50** does meet the criteria parameter **62** in relation to the current location **56**, the alerting device **64** is activated. The process then continues to node **C** as described in FIG. **12**.

FIG. **12** is a flowchart illustrating more detail of the operation of FIGs. **10** and **11**. Moving from node **B** to Step **104**, the system checks if the processor **60** is

programmed to generate an alert. In Step **103**, when the processor **60** is programmed to generate an alert, the processor **60** sends a command to the alerting device **64** to do so. In Step **106**, when no alert is required or after the alert is generated, the process checks for the presence of the transmitter **80**. When no transmitter **80** is present, the wireless communication device **36** returns to node **A** and the standby state of Step **92**. In Step **108**, when a transmitter **80** is present, the process checks if the processor **60** is programmed to require the user input **84** from the user interface **86** prior to sending a command to the transmitter **80**. When the user input **84** is required, in Step **110**, the processor **60** looks for the user input **84**. When no user input **84** is detected, the wireless communication device **36** returns to node **A** and the standby state of Step **92**. When the user input **84** is detected in Step **110**, the processor **60** generates the command to the transmitter **80** to reply to the original assignment message **32**. In Step **112**, the processor **60** checks for the presence of the second communication channel **39**. In Step **114**, When the second communication channel **39** is present, the reply **38** is sent by the transmitter **80** over the second communication channel **39**. The wireless communication device **36** then returns to node **A** and the standby state of Step **92**. In Step **116**, when the second communication channel **39** is not present, the transmitter **80** sends the reply **38** over the first communication channel **35** in which the assignment message **32** was also communicated. The wireless communication device **36** then returns to node **A** and the standby state of Step **92**.

FIG. **13** is a flowchart of the operation of the dispatch center **16** for use within the vehicle dispatch system **10** of FIG. **1**. In Step **118**, the dispatch center **16** is in a standby state. In the standby state, the dispatch center **16** reduces its operation to draw less current and require less power to operate. In Step **120**, the dispatch center **16** periodically checks for receipt of the request for dispatch **28**. When no request for dispatch **28** is received, the dispatch center **16** returns to the standby state of Step **118**. In Step **122**, when a request for dispatch **28** is received by the dispatch center **16**, the dispatch controller **18** of the dispatch center **16** generates the location parameter **50** identifying the assignment location **66** of the request for dispatch **28**. In Step **123**, the dispatch controller **18** sets the timer **19** for tracking

the time for processing of the request for dispatch **28** to matching of the assignment with the vehicle **14**. In Step **124**, the dispatch controller **18** sets a criteria parameter counter to N = 1. In Step **126**, the dispatch controller **18** generates the assignment message **32**.

FIG. **14** illustrates one embodiment of the assignment message **32**. The assignment message **32** preferably includes the address **48**, the location parameter **50**, a criteria parameter **62** and the data **52**. The address **48** identifies the wireless communication device **36** for which the assignment message **32** is directed. The location parameter **50** identifies the geographical location of the assignment being transmitted in the data **52** of the assignment message **32**. The data **52** includes all details of the assignment such as customer name, number of passengers, the required time of pick-up, etc.

The criteria parameter **62**, as described previously, is a pre-set measurement for filtering the assignment message **32** received by the wireless communication device **36** to be seen only by the vehicles **14** within the fleet **12** that meet the specified criteria. The criteria parameter **62** may be a calculation, an equation, a function, or a comparison value. The dispatch controller **18** generates the criteria parameter **62** to be sent in the assignment message **32**. FIGs. **4**, **5**, and **6**, previously described, illustrate various metrics for the criteria parameter **62**. It will be appreciated by those skilled in the art that other metrics may also be used for the criteria parameter **62**.

Referring back to FIG. **13**, in Step **128** the dispatch controller **18** sends a command to the dispatch transmitter **20** to transmit the assignment message **32** via the transmit antenna **34** to each vehicle **14** of the fleet **12** on the first communication channel **35**. The assignment message **32** is then sent to the vehicles **14** of the fleet **12** which each receive the assignment message **32** using the wireless communication device **36**. In Step **130**, the dispatch center **16** checks for receipt of the reply **38** by at least one vehicle **14**. The reply **38** is received by the dispatch center **16** via the receive antenna **40** to the dispatch receiver **22**. The dispatch receiver **22** informs the dispatch controller **18** of receipt of the reply **38**. In Step **132**, when the reply **38** has been received, the dispatch controller **18** resets the timer **19**. The dispatch controller **18** then completes the

processing of the assignment match and then returns to Node **D** and the dispatch center **16** returns to the standby state of Step **118**. In Step **134**, when no reply **38** is received by the dispatch center **16**, the dispatch controller **18** checks for timeout of the timer **19**. When the timer has not timed out, the dispatch controller **18** continues back to Step **130** periodically checking for receipt of the reply **38**. In Step **136**, when the timer **19** has timed out, the dispatch controller **18** sets the criteria parameter **62** to N = 2 which typically will relax the criteria to be used for matching the vehicle **14** with the request for dispatch **28**. The dispatch controller **18** then cycles back to Step **126** and generates the new assignment message **32**.

FIGs. **15**, **16**, and **17** illustrate various calculations of the N = 1 and N = 2 criteria parameters. In FIG. **15**, the criteria parameter **62** is first set at N = 1 to a first perimeter **140** surrounding the assignment location **66** at a first radius **142** from the assignment location **66**. The first radius **142** in one embodiment is chosen based on the time of day. For example, during peak hours the first radius **142** is set to a smaller dimension than during non-peak hours. When the wireless communication device **36** receives the assignment message **32** including the location parameter **50** and the criteria parameter **62**, it compares the location parameter **50** corresponding with the assignment location **66** to the current location **56** of the vehicle **14** in which the wireless communication device **36** resides. When the current location **56** is within the first perimeter **140**, the assignment message **32** will be processed. When the current location **56** is not within the first perimeter **140**, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received. When no reply **38** is received by the dispatch controller **18,** the criteria parameter **62** is set to N = 2 corresponding to a second perimeter **144** surrounding the assignment location **66** at a second radius **146** from the assignment location **66**. The second radius **146** is preferably larger than the first radius **142**. When the wireless communication device **36** receives the assignment message **32** including the location parameter **50** and the criteria parameter **62**, it compares the location parameter **50** corresponding with the assignment location **66** to the current location **56** of the vehicle **14** in which the wireless communication device **36** resides. When the current location **56** is within the second perimeter **144**, the

assignment message **32** will be processed. When the current location **56** is not within the second perimeter **144**, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received. When no reply **38** is received by the dispatch controller **18** indicating that no vehicle **14** is located within the second perimeter 144, the dispatch controller **18** will generate a next criteria parameter (N = 3) and continue the process previously described until the reply **38** is received.

In FIG. **16**, the criteria parameter **62** is first set at N = 1 to a first driving distance **148** away from the assignment location **66**. Upon receipt of the assignment message **32**, the wireless communication device **36** calculates the driving distance from the current location **56** of the vehicle **14** in which the wireless communication device **36** resides to the assignment location **66** that corresponds to the location parameter **50**. When the calculated driving distance is within the first driving distance **148** set for the criteria parameter **62** the assignment message **32** will be processed. When the calculated driving distance is not within the first driving distance **148** set for the criteria parameter **62**, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received. When the dispatch controller **18** does not receive the reply **38**, the criteria parameter **62** is set to N = 2 corresponding to a second driving distance **150** away from the assignment location **66.** The second driving distance **150** is preferably larger than the first driving distance **148.** Upon receipt of the assignment message **32**, the wireless communication device **36** calculates the driving distance from the current location **56** of the vehicle **14** in which the wireless communication device **36** resides to the assignment location **66** that corresponds to the location parameter **50**. When the calculated driving distance is within the second driving distance **150** set for the criteria parameter **62** the assignment message **32** will be processed. When the calculated driving distance is not within the second driving distance **150** set for the criteria parameter **62**, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received. When no reply **38** is received by the dispatch controller **18** indicating that no vehicle **14** is located within the second driving distance **150**,

the dispatch controller **18** will generate a next criteria parameter (N = 3) and continue the process previously described until the reply **38** is received.

Preferably, the wireless communication device **36** includes a navigation program for the area in which the fleet **12** operates. The wireless communication device **36** uses the navigation program to calculate the driving distance from the current location **56** to the assignment location **66**.

In FIG. **17**, the criteria parameter **62** is first set at N = 1 to a first travel time **154** equal to the difference between a first arrival time **152** and the current time **76**. Upon receipt of the assignment message **32**, the wireless communication device **36** calculates its estimated arrival time to the assignment location **66**. The current time **76** is subtracted from the estimated arrival time to calculate a travel time. When the calculated travel time of the vehicle **14** is within the first travel time **154** assigned to the criteria parameter **62**, the assignment message **32** will be processed. When the calculated travel time is not within the first travel time **154** assigned to the criteria parameter **62**, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received. When the dispatch controller **18** does not receive the reply **38**, the criteria parameter **62** is set to N = 2 corresponding to a second travel time **158** to the assignment location **66** equal to the difference between a second arrival time **156** and the current time **76.** The second travel time **158** is preferably larger than the first travel time **154**. Upon receipt of the assignment message **32**, the wireless communication device **36** calculates its estimated arrival time to the assignment location **66**. The current time **76** is subtracted from the estimated arrival time to calculate a travel time. When the calculated travel time of the vehicle **14** is within the second travel time **158** assigned to the criteria parameter **62**, the assignment message **32** will be processed. When the calculated travel time is not within the second travel time **158** assigned to the criteria parameter **62**, the assignment message **32** will be deleted and the driver of the vehicle **14** would never even be aware that it was received. When no reply **38** is received by the dispatch controller **18** indicating that no vehicle **14** is located within the second driving distance **150**, the dispatch controller **18** will generate a next criteria parameter (N = 3) and continue the process previously described until the reply **38** is received.

Preferably, the wireless communication device **36** includes a smart program for tracking of traffic conditions. The smart program calculates the travel time required based on the latest received traffic conditions. Alternatively, the wireless communication device 36 may include a program incorporating average travel times and uses the average travel times to calculate the travel time from the current location **56** to the assignment location **66**.

The invention as described eliminates many of the drawbacks of existing vehicle dispatch systems. The invention reduces the traffic congestion on the communication channels and also reduces the frequency of messages received by the vehicle driver. The invention further reduces the potential for abuse of the system from drivers accepting assignments outside their range of travel. Overall, the system and method described reduces system costs, improves system performance, and improves customer satisfaction, the most important aspects of a vehicle dispatch system.

Although the invention has been described in terms of preferred embodiments, it will be obvious to those skilled in the art that various alterations and modifications may be made without departing from the invention. Accordingly, it is intended that all such alterations and modifications be considered as within the spirit and scope of the invention as defined by the appended claims.